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Eimeriosis in Korean indigenous calves with bloody diarrhea from March, 2006 to March, 2007

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Abstract

The aim of this study was to examine the epidemiological features of Eimeria in calves with acute diarrhea. Samples were collected from between 15 days and 90 days old calves (n=83) in Gimje area from March 2006 to March 2007. Feces of bloody diarrhea were examined for the presence of Eimeria oocysts using a sucrose flotation method. Out of 83 calves, 62 (74.6%) had Eimeria oocysts. In the results of monthly analysis, the highest prevalence (12.0%) of Eimeria oocysts was found on June. In the seasonal infection rate, spring was the highest prevalence (30.1%), followed by summer (24.0%). Furthermore, the highest prevalence (44.5%) was found in calves from between 31 - 60 days old in the analysis by ages. However, there was no significant differences between female and male sex even though the prevalence was slightly bigger in female than in male. The prevalence of the present study to detect Eimria oocysts for infection may have been affected by weather-conditions in the spring. Young calves should be separated to minimize the infection from cattle as much as possible. Additional studies are necessary to find other factors for infection and combining molecular methods with a highly sensitive system for Eimeria detection could be a reliable and economic way of Eimeria eradication.

Key words: Calves, Bloody diarrhea, Eimeria

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Introduction

Bovine coccidiosis occurs mainly under 1 year old calves, particularly confined and overcrowded breeding calves after weaning when nonimmune animals become exposed to contaminated environments. Occasionally, it may occur in calves over

1 year old or even in adult cattle.[1-2] Coccidiosis is caused by protozoan parasites of the genus Eimeria and it causes significant economic losses on many calving or breeding farms. Economic losses from coccidiosis are due to increased mortality, poor growth and additional cost of treatment. Calves may be infected by ingestion of sporulated oocysts in contaminated water, feed, or pastures and by hair licking.

In coccidiosis, several Eimeria species could develope the clinical signs such as watery or bloody diarrhea. Infections with more than one species were commonly found, but monoinfections were observed in some cases[3]. Clinical coccidiosis in cattle is usually ambiguous. Symptoms are often not apparent until 3-8 weeks after initial infection[4]. Diarrhea and the presence of oocysts in the feces are not reliable indicators for golden diagnosis because there were a lot of important causes of diarrhea in cattle such as rotavirus[5], coronavirus[6], bovine viral diarrheal virus[7], salmonellosis[8], coliba-cillosis[9], gastrointestinal helminthosis[10] or malnutrition[11]. Thus, diagnosis of coccidiosis should be based on the history of the cattle population, presence of clinical signs, the abundance of oocysts of veterinary important species and the occurrence of intestinal lesions at necropsy. The primary objective of this study was to describe the pre-valence for Eimeria infection in calves with acute diarrhea.

Materials and Methods

Animals

The suspected calves with Eimeria infection were only investigated among calves showing acute enteritis based on history of clients. Calves with bloody diarrhea were between 15 days and 90 days old. Appetite was normal or anorexia. Calves were presented to the Happy Veterinary Hospital from Gimje area (Gimje city, Mankyeong, Chuksan, Baesan, Yongji, Baekgu, Buryang, Gong-deok, Cheongha, Seongdeok, Chinbong, Keumgu, Bongnam, Hwangsan, Keumsan and Kwanghwal).

Fecal samples

Diarrheal fecal samples were collected directly from calves on poly gloves within 1 or 2 days after onset of diarrhea. All samples were shipped to hospital. Total samples of 83 were analysed from March 2006 to March 2007.

Eimeria examinations

For detection of Eimeria, feces were examined using a modified sucrose flotation method with specific gravity 1.27[12]. Feces were mixed thoroughly with sucrose solution. The mixture was left for 5 min and poured into glass tube through thin gauze to remove coarse plant matter and debris. It was left 5 min again. A cover slip was loaded on the top of the glass tube which was allowed to stand for 5 min again. After 5 min, the cover was carefully lifted and placed on a slide glass for microscopic examination. Identification of Eimeria oocysts based on morphological shapes according to Georgi[13] and Soulsby[14].

Statistical analysis

All values were reported as mean and standard deviation (SD). Significant differences between the values were statistically analyzed using a one-way analysis of variance (ANOVA), followed by a two pairs Student's t test. $p<0.05$ or less was considered statistically significant.

Results

A total of 83 samples were collected and examined from calves with acute enteritis in Gimje area (Table 1).

Table 1. Detection rate of Eimeria oocysts in bloody feces of Korean indigenous calves from March 2006 to March 2007

Month	Frequency of bloody diarrhea	Detection rate (%)
2006, March	13	11 (13.2)
April	7	2 (2.4)
May	10	6 (7.2)
June	11	10 (12.0)
July	7	6 (7.2)*
August	4	4 (4.8)**
September	4	3 (3.6)**
October	3	1 (1.2)**
November	6	3 (3.6)*
December	3	3 (3.6)**
2007, January	8	6 (7.2)*
February	1	1 (1.2)**
March	6	6 (7.2)
Total	83	62 (74.6)

* Indicates significant differences ($p < 0.05$) in prevalence as compared with June.
** Indicates very significant differences ($p < 0.01$) in prevalence as compared with June.

Eimeria oocysts were found in 62 (74.6%) of 83 samples. On the frequency of bloody diarrhea and prevalence of Eimeria by monthly analysis, both frequency and prevalence were highest in March of 2006. That is, frequency was 15.6% (13/83heads) and prevalence was 13.2% (11/62 samples). The mean of frequency and prevalence were 9.5 ± 4.94 and 8.5 ± 3.53, respectively, in March.

Table 2. Prevalence of Eimeria in Korean indigenous calves with bloody diarrhea by season

Season	Frequency of bloody diarrhea (%)	Prevalence of Eimeria (%)
Spring	36 (43.3)	25 (30.1)
Summer	22 (26.5)	20 (24.0)
Fall	13 (15.6)	7 (8.4)*
Winter	12 (14.4)	10 (12.0)*
Total	83	62 (74.6%)

* Indicates significant differences ($p < 0.05$) in prevalence as compared with spring.

Table 3. Frequency of bloody diarrhea and prevalence in Korean indigenous calves by age

Ages (days)	Frequency of bloody diarrhea (%)	Prevalence of Eimeria (%)
15 - 30	31 (37.3)	16 (19.2)
31 - 60	43 (51.8)	37 (44.5)
61 - 90	9 (10.8)	9 (10.8)**
Total	83	62 (74.6)

**Indicates very significant differences ($p < 0.01$) in prevalence as compared with calves aged 31-60 days.

The second highest frequency and prevalence was found in June. On the other hand, the lowest frequency and prevalence was found in February.

Therefore, the peak of frequence and prevalence was found in June and declined from 12.0% to 7.2% in July, and 1.2% in October. When the frequency and prevalence of June were compared to those of the remaining months, there were significant differences ($p<0.05$) in January, July and November, and there were very significant differences ($p<0.01$) in February, August, September, October and December.

Table 4. Compare of sexual difference in prevalence of Eimeria

Sex	Frequency of bloody diarrhea (%)	Prevalence of Eimeria (%)
Female	43 (51.8)	32 (38.5)
Male	40 (48.1)	30 (36.1)
Total	83	62 (74.6)

However, there was no significant difference ($p>0.05$) in frequency and prevalence between June and others (March, April and May). On the frequency of bloody diarrhea and prevalence of Eimeria by seasonal analysis (Table 2), both of them were top in spring, followed by summer. A statistically significant difference in the frequency and prevalence was observed in fall and in winter when compared with that of the spring ($p<0.05$), but not in summer ($p>0.05$). Table 3 shows that the frequency of bloody diarrhea and prevalence of Eimeria by analysis of age. Bloody diarrhea was observed most frequently in calves aged 31-60 days and detection rate of oocysts was highest in those. The lowest frequency and prevalence were in calves 61-90 day old. In this study, there was statistically significant difference ($p<0.01$) in the frequency and prevalence between two groups. In the analysis of prevalence by sex (Table 4), there was no significant difference ($p>0.05$) between female and male. That is, the prevalence of female and male were 38.5% and 36.1%, respectively.

Discussion

A few reports are available on the clinical significance of naturally acquired bovine coccidiosis[3,15]. Here, the results from this study suggest that at any time during the breeding calves, they can be affected with *Eimeria* spp. even though the rate was low or high. The prevalence in February (1.2%) and October (1.2%) was significantly low. This could be due to the fact that calves were kept under different conditions which produced low frequency of bloody diarrhea. In contrast, the high monthly prevalence in March (13.2%), May (7.2%) and June (12.0%) was shown to increased frequency of bloody diarrhea in spring and summer. Therefore, the fact that the high frequency of bloody diarrhea related to the high prevalence of Eimeria, suggests that infection of Eimeria was probably affected by stress associated with weaning and changes in environmental conditions, especially temperature[16].

Our results did not agree that of prevalence of Eimeria in the study of Matjila and Penzhorn[17] who detected *Eimeria* spp. in both adult cattle and calves. The high prevalence of *Eimeria* spp. has been reported in May which is

beginning of winter and temperature tend to be low, especially at night. Heitman et al[18] indicated a difference in prevalence due to different weather patterns. Although there were not statistically significant in a drought year, many of the risk factors potentially related to environment, including feeding on the ground, precipitation during the calving season, and soil and vegetation type, may play a more important role in a more typical weather Canadian calving season[19].

As like Table 3, the prevalence in older calves was lower than in younger. This result was similar to other authors[16,20,21] reporting that coccidiosis is generally a disease of young animal. It could also be explained that older animals can be more resistant to coccidial infection because their immunity will be increased by times.

Oocysts of the predominating species were first observed in 3 weeks old calves. In case of *E bovis*, *E zuerni* and *E auburnensis* with occupied periods of at least 17 days, which means according to Svensson[22] that infections took place within the first day of life. We have not detected Eimeria oocysts in 15 and 18 days old calf, which was not same with Svensson. This early shedding seems to be possible due to the short occupied period of 8-10 days. It seems of some interest that the excretion of *E bovis* oocysts peaked when calves had reached an age of 5-6 weeks[23].

In this study, comparing prevalence of Eimeria oocysts with sex, the prevalence of Eimeria oocysts in females was slightly higher than that of in males. However, a statistically significant difference in the prevalence was not observed in between female and male sex. These findings indicate that sex may be not affect the prevalence of Eimeria oocysts.

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